

Please ensure that your abstract fits into one column on one page and complies with the *Instructions to Authors* available from the Abstract Submission web page.

Evidence from hydrogen isotopes in meteorites for a subsurface hydrogen reservoir on Mars

TOMOHIRO USUI¹, CONEL M. O'D. ALEXANDER²,
JIANHUA WANG², JUSTIN I. SIMON³, JOHN H. JONES³

¹Dept. of Earth and Planet. Sci., Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro, Tokyo 152-8551, Japan.

(*correspondence: tomohirusui@geo.titech.ac.jp)

²Dept. of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Rd. NW, Washington DC 20015-1305, USA.

³ARES, Johnson Space Center, NASA, 2101 NASA parkway, Houston, TX 77058, USA.

The surface geology and geomorphology of Mars indicates that it was once warm enough to maintain a large body of liquid water on its surface, though such a warm environment might have been transient. The transition to the present cold and dry Mars is closely linked to the history of surface water, yet the evolution of surficial water is poorly constrained.

We have conducted *in situ* hydrogen isotope (D/H) analyses of quenched and impact glasses in three Martian meteorites (Yamato 980459, EETA79001, LAR 06319) by Cameca ims-6f at DTM following the methods of [1]. The hydrogen isotope analyses provide evidence for the existence of a distinct but ubiquitous water/ice reservoir ($D/H = 2\text{--}3$ times Earth's ocean water: SMOW) that lasted from at least the time when the meteorites crystallized (173–472 Ma) to the time they were ejected by impacts (0.7–3.3 Ma), but possibly much longer [2]. The origin of this reservoir appears to predate the current Martian atmospheric water ($D/H = \sim 5\text{--}6 \times \text{SMOW}$) and is unlikely to be a simple mixture of atmospheric and primordial water retained in the Martian mantle ($D/H \approx \text{SMOW}$ [1]). Given the fact that this intermediate-D/H reservoir ($2\text{--}3 \times \text{SMOW}$) is observed in a diverse range of Martian materials with different ages (e.g., SNC meteorites, including shergottites such as ALH 84001; and Curiosity surface data [3]), we conclude that this intermediate-D/H reservoir is likely a global surficial feature that has remained relatively intact over geologic time. We propose that this reservoir represents either hydrated crust and/or ground ice interbedded within sediments. Our results corroborate the hypothesis that a buried cryosphere accounts for a large part of the initial water budget of Mars.

REFERENCES: [1] Usui et al. (2012) *EPSL* **357-358**, 119-129. [2] Usui et al. (2015) *EPSL* **410**, 140-151. [3] Mahaffy et al. *Science* **347**, 412-414.